BS EN IEC 61643-01:2025+A11:2025



BSI Standards Publication

Low-voltage surge protective devices

Part 01: General Requirements and test methods

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National foreword

This British Standard is the UK implementation of EN IEC 61643-01:2025+A11:2025. It is derived from IEC 61643-01:2024. It partially supersedes BS EN 61643-11:2012+A11:2018.

The start and finish of text introduced or altered by amendment A11 is indicated in the text by tags. Tags indicating changes to text carry the number of the CENELEC amendment. For example, text altered by CENELEC amendment A11 is indicated by [A11〉 〈A11].

The UK participation in its preparation was entrusted to Technical Committee PEL/37, Surge Arresters - High Voltage.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Amendments/corrigenda issued since publication

Date	Text affected

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Low-voltage surge protective devices - Part 01: General Requirements and test methods (IEC 61643-01:2024)

Parafoudres basse tension - Partie 01: Exigences générales et méthodes d'essai (IEC 61643-01:2024)

Überspannungsschutzgeräte für Niederspannung - Teil 1: Allgemeine Anforderungen und Prüfverfahren (IEC 61643-01:2024)

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Comité Européen de Normalisation Electrotechnique
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European foreword

The text of document 37A/419/FDIS, future edition 1 of IEC 61643-01, prepared by SC 37A "Low-voltage surge protective devices" of IEC/TC 37 "Surge arresters" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61643-01:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2026-04-30
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2028-04-30

This document partially supersedes EN 61643-11:2012 and all of its amendments and corrigenda (if any).

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This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZZ, which is an integral part of EN IEC 61643-01:2025/A11:2025.

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Endorsement notice

The text of the International Standard IEC 61643-01:2024 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60038	NOTE	Approved as EN 60038
IEC 60060-2:2010	NOTE	Approved as EN 60060-2:2011 (not modified)
IEC 60060-3:2006	NOTE	Approved as EN 60060-3:2006 (not modified)
IEC 60269-1:2006	NOTE	Approved as EN 60269-1:2007 (not modified)
IEC 60269-1:2006/A1:2009	NOTE	Approved as EN 60269-1:2007/A1:2009 (not modified)
IEC 60269-1:2006/A2:2014	NOTE	Approved as EN 60269-1:2007/A2:2014 (not modified)
IEC 60269-2:2013	NOTE	Approved as HD 60269-2:2013
IEC 60269-2:2013/A1:2016	NOTE	Approved as HD 60269-2:2013/A1:2022 (not modified)
IEC 60320 series	NOTE	Approved as EN 60320 series

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IEC 60364 series	NOTE	Approved as HD 60364 series
IEC 60364-4-44:2007	NOTE	Approved as HD 60364-4-442:2012
IEC 60364-5-51	NOTE	Approved as HD 60364-5-51
IEC 60603 series	NOTE	Approved as EN 60603 series
IEC 60947-1	NOTE	Approved as EN IEC 60947-1
IEC 60947-5-1	NOTE	Approved as EN 60947-5-1
IEC 61008-1	NOTE	Approved as EN 61008-1
IEC 61083-2:2013	NOTE	Approved as EN 61083-2:2013 (not modified)
IEC 61083-3:2020	NOTE	Approved as EN IEC 61083-3:2021 (not modified)
IEC 61140:2016	NOTE	Approved as EN 61140:2016 (not modified)
IEC 61643-12	NOTE	Approved as CLC/TS 61643-12
IEC 61643-21	NOTE	Approved as EN 61643-21
IEC 61643-311:2013	NOTE	Approved as EN 61643-311:2013 (not modified)
IEC 61643-312:2013	NOTE	Approved as EN 61643-312:2013 (not modified)
IEC 61643-321:2001	NOTE	Approved as EN 61643-321:2002 (not modified)
IEC 61643-331:2020	NOTE	Approved as EN IEC 61643-331:2020 (not modified)
IEC 61643-341:2020	NOTE	Approved as EN IEC 61643-341:2020 (not modified)
IEC 61643-351:2016	NOTE	Approved as EN 61643-351:2017 (not modified)
IEC 61643-352:2018	NOTE	Approved as EN IEC 61643-352:2018 (not modified)
IEC 62305 series	NOTE	Approved as EN IEC 62305 series
IEC 62475:2010	NOTE	Approved as EN 62475:2010 (not modified)
ISO 2039-2:1987	NOTE	Approved as EN ISO 2039-2:1999 (not modified)
ISO 4892-2:2013	NOTE	Approved as EN ISO 4892-2:2013 (not modified)

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European foreword to Amendment A11

This document (EN IEC 61643-01:2025/A11:2025) has been prepared by Technical Committee CLC/TC 37A "Low voltage surge protective devices".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2026-04-30
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2028-04-30

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 61643-01 ED1 are prefixed "Z".

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60060-1	2010	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	2010
IEC 60068-2-11	2021	Environmental testing - Part 2–11: Tests - Test Ka: Salt mist	EN IEC 60068-2-11	2021
IEC 60068-2-14	2023	Environmental testing - Part 2–14: Tests - Test N: Change of temperature	EN IEC 60068-2-14	2023
IEC 60068-2-30	2005	Environmental testing - Part 2–30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	2005
IEC 60068-2-78	2012	Environmental testing - Part 2–78: Tests - Test Cab: Damp heat, steady-state	EN 60068-2-78	2013
IEC 60099-4	2014	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems	EN 60099-4	2014
IEC 60112	-	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN IEC 60112	2020
IEC 60269	series	Low-voltage fuses - Part 1: General requirements	EN 60269-1 + 1 + 2	2007 2009 2014
		Low-voltage fuses - Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) - Examples of standardized systems of fuses A to K	HD 60269-2 + 1	2013 2022
IEC 60364-5-53	2019	Low-voltage electrical installations - Part 5-53: Selection and erection of electrical equipment - Devices for protection for safety, isolation, switching, control and monitoring	HD 60364-5-53	2022
+ MD 1	2020		- + C	- 2022-08

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Publication	Year	Title	EN/HD	Year
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
			+ 1	2000
			+ A2	2013
IEC 60664-1	2020	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests	EN IEC 60664-1	2020
IEC 60695-2-11	2021	Fire hazard testing - Part 2–11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end products (GWEPT)	EN IEC 60695-2-11	2021
IEC 60695-10-2	2014	Fire hazard testing - Part 10–2: Abnormal heat - Ball pressure test method	EN 60695-10-2	2014
IEC 60898	series	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation	EN 60898-1	2019
		Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for DC operation	+ 1	2024
			+ 11	2024
IEC 60947-2	2016	Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	EN 60947-2	2017
+ MD1	2019		+ 1	2020
IEC 61000	series	Electromagnetic compatibility (EMC)	EN IEC 61000-6-1	2016
			EN IEC 61000-6-3	2021
IEC 61180	-	High-voltage test techniques for low-voltage equipment - Definitions, test and procedure requirements, test equipment	EN 61180	2016
IEC 61210 (mod)	2010	Connecting devices - Flat quick-connect terminations for electrical copper conductors - Safety requirements	EN 61210	2010
IEC/TR 61643-03	2024	Low-voltage surge protective devices - Part 03: SPD testing guide	-	-
ISO 4892-1	2016	Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance	EN ISO 4892-1	2016
ISO 4892-2	2013	Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps	EN ISO 4892-2	2013
+ MD1	2021	Amendment 1: Classification of daylight filters	+ A1	2021
ISO 4628-3	2016	Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 3: Assessment of degree of rusting	EN ISO 4628-3	2016

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A11 Annex ZB
(informative)

Vibration and shock test

ZB.1 Introduction

This annex gives information if the manufacturer declares performances for vibration and shock conditions.

ZB.2 Vibration and shock test

Vibration and shock tests shall be performed according to

— EN 60068-2-6 for sinusoidal Vibration test,

— EN 60068-2-64 for broadband random Vibration test, and

— EN 60068-2-27 for shock test.

Usually SPD are subject to mechanical stress due to transportation. This should be checked by a vibration and shock test with the parameters given in EN 60721-3-2.

Special application of SPDs may require additional vibration and shock tests.

The typical values can be as shown in Table ZB.1.

Table ZB.1 — Typical vibration and shock test parameters for usual specific applications

Environment	Classification of mechanical conditions	Sinusoidal vibrations	Shock	Random vibrations
Commercial building	3M3	0,75 mm 0,2g FT 8 Hz 1–150 Hz 5 cycles	5g 6ms	NA
Industrial	3M4	3,5 mm 1g FT 8,5 Hz 1–150 Hz 10 cycles	15g 11ms	15g 6ms 100/axis/direction
	3M5	3,5 mm 1g FT 8,5 Hz 1–150 Hz 10 cycles	30g 6ms	25g 6ms 100/ axis/direction
Hard	3M6	7,5 mm 2g FT 8 Hz 1–150 Hz 10 cycles	30g 6ms	25g 6ms 100/ axis/direction
Extreme	3M8	15 mm 5g FT 9 Hz 1–150 Hz 5 cycles	30g 6ms	25g 6ms 100/ axis/direction
NOTE The values are derived from EN 60721-3-3:1995[1]				

Furthermore, other applications like railway may require different parameters that are given in corresponding standards or directly from application. For instance, required parameters for railway vibration and shock tests are given in EN 61373.

[1] As impacted by EN 60721-3-3:1995/A2:1997.

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During the sinusoidal and random vibration tests (if requested) for special application, the sample should be powered under U_c with a short circuit capability of at least 5A.

ZB.3 Pass criteria

Pass criteria C, D, E, G and I according to Table 3 shall apply. 〈A11〉

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Annex ZZ
(informative)

Relationship between this European standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered

This European standard has been prepared under a Commission's standardization request relating to harmonized standards in the field of the Low Voltage Directive, M/511, to provide one voluntary means of conforming to safety objectives of Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZ.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding safety objectives of that Directive, and associated EFTA regulations.

Table ZZ.1 — Correspondence between this European standard and Annex I of Directive 2014/35/EU [2014 OJ L96]

Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
(1)(a)	Clause 4 Clause 6 Clause 7 8.2 9.2	
(1)(b)	Clause 6 8.2 8.4 9.2 9.4	
(1)(c)	Clause 7 9.1.1 Annex A	
(2)(a)	4.6 8.3.1 8.3.3 9.3.1 9.3.3 Table 3 - Pass criteria C, E, I, H, J, K Annex A	

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Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
(2)(b)	8.3.5 8.3.6.1.1 8.3.6.2 8.3.6.3 8.3.6.4 8.3.9 8.6.1.1 8.6.1.2 8.6.1.3 8.6.6 9.3.5 9.3.6 9.3.6.2 9.3.6.3 9.3.6.4 9.3.9 9.6.1.1 9.6.1.2 9.6.1.3 Table 3 pass criteria Q Annex A Annex E	
(2)(c)	8.5.6.1 8.5.6.2	
(2)(d)	8.3.7 8.3.8 8.4.4 8.6.2 9.3.7 9.3.8 9.4.4 Annex D.2.2	
(3)(a)	8.4.5 9.4.5	

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Safety objectives of Directive 2014/35/EU	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
(3) ( )	8.5.2 8.5.3 8.6.2 9.3.6.1 9.5.2 9.5.2 Annex D.1.1 Annex D.1.2 Annex D.1.3 Annex D.2.1	
(3) ( )	8.3.6.1.1 8.3.6.3 8.3.6.4 8.3.9 8.6.1.2 8.6.1.3 8.6.6 9.3.6 9.3.6.3 9.3.6.4 9.3.9 9.6.1.2 9.6.1.3 Table 3 pass criteria Q Annex E	

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WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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LOW-VOLTAGE SURGE PROTECTIVE DEVICES –

Part 01: General requirements and test methods

FOREWORD

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IEC 61643-01 has been prepared by subcommittee SC37A Low-voltage surge protective devices, of IEC technical committee 37: Surge arresters. It is an International Standard.

This document, together with IEC 61643-11:—[1] (second edition), cancels and replaces the first edition of IEC 61643-11 published in 2011. This edition constitutes a technical revision.

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This edition includes the following significant technical changes with respect to the first edition of IEC 61643-11:

a) Clarification on test application either to a complete SPD, to a "mode of protection", or to a complete "SPD assembly";

b) Additional measurement of voltage protection level on "combined modes of protection" between live conductors and PE (see new Annex F);

c) Additional duty test for T1 SPD and T2 SPD with follow current to check for increased follow current at lower impulse current amplitude (see 9.3.5.5);

d) Modified and amended short circuit current test requirements to better cover up-to-date internal SPD disconnector technologies (see 9.3.6.3);

e) Improved dielectric test requirements for the SPD's main circuits and added dielectric test requirements for "electrically separated circuits" (see 9.3.7 and 9.3.8);

f) Additional clearance requirements for "electrically separated circuits" (see 9.4.4);

g) Additional information and details for SPDs for DC installations.

The text of this International Standard is based on the following documents:

Draft	Report on voting
37A/419/FDIS	37A/422/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61643 series, published under the general title *Low-voltage surge protective devices*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This document is a product family standard dealing with the safety and performance of Surge Protective Devices (SPDs) and takes precedence over horizontal and generic standards covering the same subject.

This part of IEC 61643 addresses the general safety and performance tests for SPDs.

This document recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of SPDs when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

This document takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the SPD is connected to the supply mains. However, national wiring rules might differ.

If the intended applications of an SPD are covered by different parts of the IEC 61643-X1 series of standards, all relevant parts are applied.

This document is only to be applied together with the latest edition of one or more of the subsequent parts of the IEC 61643-X1 series of standards.

SPDs containing additional features or functions not addressed in this document and the relevant subsequent part(s) can require additional consideration and tests to ensure the main SPD function is not adversely affected and no hazards can arise from these additional features or functions. If appropriate standards exist to cover such functions, they are to be applied.

There are three SPD Types for SPDs intended to be installed in power systems:

T1 SPDs are subjected to impulses simulating conducted partial lightning currents.

T2 SPDs and T3 SPDs are subjected to impulses of shorter duration.

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LOW-VOLTAGE SURGE PROTECTIVE DEVICES –

Part 01: General requirements and test methods

1 Scope

This part of IEC 61643 contains the common requirements for all SPDs.

This document is applicable to devices for surge protection against indirect and direct effects of lightning or other transient overvoltages, hereafter referred to as Surge Protective Devices (SPDs).

SPDs are intended to be connected to circuits or equipment rated up to 1 000 V AC (RMS) or 1 500 V DC. Performance and safety requirements, tests and ratings are specified in this document. SPDs contain at least one nonlinear component and are intended to limit surge voltages and divert surge currents.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-2-11:2021, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-14:2023, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60099-4:2014, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60269 (all parts), *Low-voltage fuses*

〚A11〛 IEC 60364-5-53:2019,[2] *Low-voltage electrical installations -- Part 5-53: Selection and erection of electrical equipment - Protection, isolation, switching, control and monitoring* 〚A11〛

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60695-2-11:2021, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end products (GWEPT)*

〚A11〛 [2] As impacted by IEC 60364-5-53:2019/AMD1:2020. 〚A11〛

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IEC 60695-10-2:2014, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method*

IEC 60898(all parts), *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations*

IEC 60947-2:2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*
IEC 60947-2:2016/AMD1:2019

IEC 61000 (all parts), *Electromagnetic compatibility (EMC)*

IEC 61180, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

IEC 61210:2010, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

IEC TR 61643-03:2024, *Low-voltage surge protective devices – Part 03: SPD testing guide*

IEC 61643-11:— [A11] 3 [A11], *Low-voltage surge protective devices – Part 11: Surge protective devices connected to AC low-voltage power systems – Requirements and test methods*

[A11] ISO 4892-1:2016, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

ISO 4892-2:2013,[4] *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps - Amendment 1: Classification of daylight filters*

ISO 4628-3:2016, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 3: Assessment of degree of rusting* [A11]

3 Terms, definitions, abbreviated terms and symbols

For the purposes of this document, the following terms, definitions, abbreviated terms and symbols apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1 Terms and definitions

3.1.1
1,2/50 voltage impulse
voltage impulse with a nominal virtual front time of 1,2 µs and a nominal time to half-value of 50 µs

Note 1 to entry: IEC 60060-1 provides the voltage impulse definitions of front time, time to half-value and waveshape.

3.1.2
8/20 current impulse
current impulse with a nominal virtual front time of 8 µs and a nominal time to half-value of 20 µs

Note 1 to entry: IEC 62475 provides the current impulse definitions of front time, time to half-value and waveshape.

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[A11] 3 [A11] Under preparation. Stage at the time of publication: IEC/AFDIS 61643-11:2024.
[A11] 4 As impacted by ISO 4892-2:2013/AMD1:2021. [A11]

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3.1.3
acceptance test
contractual test to prove to the customer that the item meets certain conditions of its specification

[SOURCE: IEC 60050-151:2001, 151-16-23]

3.1.4
combination SPD
SPD that contains either at least one combination mode of protection or at least one voltage limiting mode of protection and one voltage switching mode of protection

3.1.5
combination mode of protection
mode of protection that incorporates both, voltage switching components and voltage limiting components

3.1.6
combination wave
wave characterized by defined voltage amplitude (U_{OC}) and waveshape under open-circuit conditions and a defined current amplitude (I_{CW}) and waveshape under short-circuit conditions

Note 1 to entry: The voltage amplitude, current amplitude and waveform that is delivered to the SPD are determined by the combination wave generator (CWG) impedance Z_f and the impedance of the DUT.

3.1.7
combination wave generator short-circuit current
I_{CW}
prospective short-circuit current of the combination wave generator, at the point of connection of the device under test

Note 1 to entry: When the SPD is connected to the combination wave generator, the current that flows through the device is generally less than I_{CW}.

3.1.8
continuous current
I_C
current flowing through the SPD's mode of protection while energized at U_{test}

3.1.9
current path
electrical path intended to conduct at least part of an impulse current applied to an SPD`s mode of protection

Note 1 to entry: An SPD`s mode of protection may contain only one current path or several current paths, when voltage limiting and/or voltage switching components are connected in parallel.

Note 2 to entry: Examples are provided in Annex B of IEC TR 61643-03:2024.

3.1.10
decoupling network
electrical circuit intended to prevent surge energy from being propagated to the power network during energized testing of SPDs

Note 1 to entry: This electrical circuit is sometimes called a "back filter".

3.1.11
degradation (of performance)
undesired permanent departure in the operational performance of equipment or a system from its intended performance

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3.1.12
degree of protection of enclosure
IP
classification preceded by the symbol IP indicating the extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and possibly harmful ingress of water

3.1.13
PE connection
connection provided on an SPD and intended for the electric connection with the earthing arrangement

3.1.14
electrically separated circuit
electric circuit which is provided with terminations for connection to external circuits and insulated from the SPD main circuit(s) according to the requirements for simple or for protective separation

Note 1 to entry: Electrical circuits not provided with at least simple or even protective separation from the SPD main circuit(s) are considered as part of the main circuit(s).

3.1.15
extra-low voltage
ELV
voltage not exceeding the maximum value of the prospective touch voltage which is permitted to be maintained indefinitely under specified conditions of external influences

Note 1 to entry: According to IEC 61140, values for ELV stands for voltages below or equal to 50 V AC or 120 V DC.

[SOURCE: IEC 61140:2016, 3.26]

3.1.16
flush-mounted
adjective qualifying a device mounted into a recess in a mechanical structure so that the shape of the mounting surface remains essentially unchanged

[SOURCE: IEC 60050-151:2001, 151-16-40]

3.1.17
follow current
I_f
peak current supplied by the electrical power system and flowing through the SPD after a discharge current impulse

3.1.18
highest crest value of measured voltages
U_{max}
highest value of voltage measured between the connections of the SPD during the application of impulses of specified waveshape and amplitude

3.1.19
impulse discharge current
I_{imp}
crest value of a discharge current through an SPD's mode of protection with specified charge transfer Q and specified specific energy W/R in the specified time

Note 1 to entry: This is used to characterize T1 SPDs or category D1 (IEC 61643-21) tested SPDs.

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3.1.20
isolation
disconnection providing adequate insulation between electrical equipment, a system, an installation or part of an installation and their energy sources

[SOURCE: IEC 60050-195:2021, 195-06-23]

3.1.21
live part
conductive part intended to be energized under normal operating conditions, including the neutral conductor and mid-point conductor, but excluding the PEN conductor, PEM conductor and PEL conductor

[SOURCE: IEC 60050-195:2021, 195-02-19]

3.1.22
load-side surge withstand capability (for a two-port SPD)
ability of a two-port SPD to withstand surges on the output connections originating in circuitry downstream of the SPD

3.1.23
maximum continuous operating voltage
U_C
maximum voltage, which may be continuously applied to the SPD's mode of protection

Note 1 to entry: U_C may exceed 1 000 V AC or 1 500 V DC.

3.1.24
maximum discharge current
I_{max}
crest value of a current through a T2 SPD's mode of protection having an 8/20 current impulse and magnitude according to the manufacturer's specification, which is equal to or greater than I_n

Note 1 to entry: I_{max} can be withstood at least once.

3.1.25
means for short-circuiting the SPD
SC-means
internal method for short-circuiting an SPD under specified conditions, with a current carrying capacity equal to the short-circuit current rating I_{SCCR} of the SPD

3.1.26
measured limiting voltage
highest value of voltage measured between the connections of the SPD during the application of impulses of specified waveshape and amplitude

3.1.27
minimum short-circuit current rating
$I_{SCCRMIN}$
minimum prospective short-circuit current from the power system for which the SPD, in conjunction with the internal disconnector(s), is rated

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3.1.28
mode of protection
intended circuitry between two connections, that contains one or more protective components, declared by the manufacturer

Note 1 to entry: Additional connections may be included within this circuitry.

Note 2 to entry: Such modes may be line to line, line to neutral, line to PE, neutral to PE, plus to minus, plus to PE and minus to PE.

Note 3 to entry: Examples are provided in Annex B of IEC TR 61643-03:2024.

3.1.29
multimode SPD
SPD with more than one mode of protection, or a set of electrically interconnected SPDs offered as a unit

3.1.30
nominal discharge current
I_n
crest value of an 8/20 current impulse through an SPD's mode of protection

Note 1 to entry: This current impulse can be withstood multiple times.

Note 2 to entry: This is used to characterize T2 SPDs or category E1 (IEC 61643-21) tested SPDs.

3.1.31
nominal varistor voltage
U_{1mA}
voltage across the MOV measured at 1 mA DC

3.1.32
nominal voltage of a system
suitable approximate value of voltage used to designate or identify a system

[SOURCE: IEC 60050-601:1985, 601-01-21]

3.1.33
one-port SPD
SPD having no intended series impedance

Note 1 to entry: A one-port SPD may have separate input and output connections.

Note 2 to entry: Overcurrent protection devices e.g. fuses or CBs are not considered as specific intended series impedance.

3.1.34
open-circuit mode
OCM
end-of-life behaviour whereby an SPDA changes to a permanent high impedance or open-circuit state under specified conditions

Note 1 to entry: A low impedance intermediate state is possible for a limited time until the final end-of-life mode is reached.

3.1.35
open-circuit voltage
U_{OC}
open-circuit voltage of the combination wave generator at the point of connection of the device under test

Note 1 to entry: This is used to characterize T3 SPDs.

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3.1.36
ordinary person
person who is neither a skilled person nor an instructed person

[SOURCE: IEC 60050-195:2021, 195-04-03]

3.1.37
output contact
contact included in a circuit separate from the main circuit of an SPD, and linked to a disconnector or status indicator

3.1.38
overvoltage category
numeral defining a transient overvoltage condition

Note 1 to entry: Further information on overvoltage categories is provided in IEC 60364-4-443.

[SOURCE: IEC 60050-581:2008, 581-21-02, modified – addition of Note 1 to entry]

3.1.39
PELV system
electric system in which the voltage cannot exceed the value of extra-low voltage:

– under normal conditions and
– under single fault conditions, except earth faults in other electric circuits

Note 1 to entry: PELV is the abbreviation for protective extra-low voltage.

Note 2 to entry: PELV has protective separation from all circuits other than PELV, SELV or earth.

[SOURCE: IEC 60050-826:2022, 826-12-32]

3.1.40
PEM conductor
PEM
conductor combining the functions of both a protective earthing conductor and a mid-point conductor

[SOURCE: IEC 60050-195:2021, 195-02-13]

3.1.41
PEN conductor
PEN
conductor combining the functions of both a protective earthing conductor and a neutral conductor

[SOURCE: IEC 60050-195:2021, 195-02-12]

3.1.42
prospective short-circuit current
I_P
current which would flow at a given location in a circuit if it were short-circuited at that location by a link of negligible impedance

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3.1.43
protective conductor
PE
conductor provided for purposes of electrical safety

[SOURCE: IEC 60050-195:2021, 195-02-09]

3.1.44
protective conductor current
I_{PE}
current expected to flow through the PE connection of the SPD

3.1.45
(electrically) protective separation
separation of one electric circuit from another by means of:

– double insulation; or
– basic insulation and electrically protective screening (shielding); or
– reinforced insulation

[SOURCE: IEC 61140:2016, 3.24]

3.1.46
rated load current
I_L
maximum current that can be continuously conducted between the input and the output connections of the SPD

Note 1 to entry: This current does not influence the impedance of current-limiting components.

3.1.47
residual current device
RCD
mechanical switching device or association of devices designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions

[SOURCE: IEC 60050-442:1998, 442-05-02]

3.1.48
residual voltage
U_{res}
crest value of voltage measured between the connections of the SPD during the passage of discharge current

3.1.49
routine test
conformity test made on each individual item during or after manufacture

[SOURCE: IEC 60050-151:2001; 151-16-17]

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3.1.50
SELV system
electric system in which the voltage cannot exceed the value of extra-low voltage:

– under normal conditions and

– under single fault conditions, including earth faults in other electric circuits

Note 1 to entry: SELV is the abbreviation for safety extra-low voltage.

Note 2 to entry: SELV has simple separation from PELV, other SELV systems and earth, and protective separation from all other circuits.

[SOURCE: IEC 60050-195:2021, 195-06-28 modified – addition of Note 2 to entry]

3.1.51
short-circuit current rating
I_{SCCR}
maximum prospective short-circuit current from the power system for which the SPD, in conjunction with any external disconnector(s) specified, is rated

Note 1 to entry: The term SPD includes internal disconnectors as well as any internal SC-means which are part of the SPD.

3.1.52
short-circuit mode
SCM
end-of-life behaviour whereby an SPDA changes to an intended permanent low impedance or short-circuit state under specified conditions

3.1.53
short-circuiting SPD
SPD which changes its characteristic by an SC-means to an intentional internal short-circuit due to an impulse according to the transition surge current rating

3.1.54
simple separation
separation between electric circuits or between an electric circuit and local earth by means of basic insulation

[SOURCE: IEC 60050-195:2021, 195-06-30]

3.1.55
skilled person
electrically skilled person
person with relevant education and experience to enable him or her to perceive risks and to avoid hazards that electricity can create

[SOURCE: IEC 60050-195:2021, 195-04-01]

3.1.56
sparkover voltage
maximum voltage value at which the sudden change from high to low impedance starts for a voltage switching SPD or combination SPD

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3.1.57
SPD assembly
SPDA
one SPD or a set of SPDs, in both cases including all SPD disconnectors required by the SPD manufacturer, providing the required overvoltage protection for a type of system earthing

[SOURCE: IEC 60364-5-53:2019, 530.3.8]

3.1.58
SPD disconnector
disconnector
device for disconnecting an SPD, or part of an SPD, from the power system in the event of SPD end-of-life

Note 1 to entry: This disconnecting device is not required to have isolating capability for safety purposes. It is to prevent a persistent fault on the system and is used to give an indication of an SPD's end-of-life. Disconnectors can be internal (built in) or external (required by the manufacturer). There may be more than one disconnector function, for example an over-current protection function and a thermal protection function. These functions may be in separate units.

3.1.59
specific energy for T1 SPD test
W/R
energy dissipated by a unit resistance of 1 Ω with the impulse discharge current I_{imp}

Note 1 to entry: This is equal to the time integral of the square of the current ($W/R = \int i^2 \mathrm{d}t$).

3.1.60
status indicator
means to indicate the operational status of an SPD, an SPD disconnector, an SPDA or a part of an SPD

Note 1 to entry: Such indicators may be local with visual and/or audible alarms and/or may have remote signalling and/or output contact capability.

3.1.61
surge protective device
SPD
device that contains at least one nonlinear component that is intended to limit surge voltages and divert surge currents

Note 1 to entry: An SPD is a complete unit or device, having appropriate connecting means.

Note 2 to entry: Secondary functions may be incorporated, such as current-limiting function.

Note 3 to entry: Nonlinearity may be caused by frequency change.

Note 4 to entry: The IEC 61643-3xx series of standards covers surge protective components.

3.1.62
temporary overvoltage test value
U_T
test voltage applied to the SPD for a specific duration t_T, to simulate the stress under temporary overvoltage (TOV) conditions

3.1.63
test current
I_{test}
test current derived from specific application conditions

Note 1 to entry: This parameter is only used for test purposes.

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3.1.64
test voltage
U_{test}
test voltage derived from the system voltage

Note 1 to entry: This parameter is only used for test purposes.

3.1.65
thermal equilibrium
state reached when the temperature of the parts of a component or equipment operating in a given environment no longer varies faster than a specified limit

[SOURCE: IEC 60050-151:2001, 151-16-33]

3.1.66
thermal stability
condition of the SPD when the current flowing into the SPD or the power dissipation does not increase during a defined time of application of the maximum continuous operating voltage U_C

3.1.67
total discharge current
I_{Total}
current which flows through the PE connection of a multimode SPD during the total discharge current test

Note 1 to entry: The aim is to take into account cumulative effects that occur when multiple modes of protection of a multimode SPD conduct at the same time.

Note 2 to entry: I_{Total} is particularly relevant for T1 SPDs and is used for the purpose of lightning protection equipotential bonding according to IEC 62305 series.

Note 3 to entry: This is sometimes called "Total surge current".

Note 4 to entry: The PE connection is sometimes called "common connection C".

Note 5 to entry: A multimode SPD is sometimes called multi-connection SPD.

3.1.68
transition surge current rating
I_{trans}
crest value of an 8/20 current impulse for T2 SPD or an impulse discharge current for T1 SPD, that will force a short-circuiting SPD into an intended short-circuit

3.1.69
two-port SPD
SPD having a specific series impedance connected between separate input and output connections

3.1.70
type of SPD

3.1.70.1
T1 SPD
SPD that is tested with the impulse discharge current I_{imp}, with an 8/20 current impulse having a crest value equal to the crest value of I_{imp}, and, if relevant, with a 1,2/50 voltage impulse

Note 1 to entry: This was called class I test in IEC 61643-11:2011.

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3.1.70.2
T2 SPD
SPD that is tested with the nominal discharge current I_n, and, if relevant, with a 1,2/50 voltage impulse

Note 1 to entry: This was called class II test in IEC 61643-11:2011.

3.1.70.3
T3 SPD
SPD that is tested with the combination wave with an open circuit voltage U_{OC}

Note 1 to entry: This was called class III test in IEC 61643-11:2011.

3.1.71
type test
conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.1.72
voltage fluctuation
series of voltage changes or a continuous variation of the RMS or peak value of the voltage

3.1.73
voltage limiting SPD
voltage clamping SPD
SPD that contains only voltage limiting mode(s) of protection (voltage clamping mode(s) of protection)

Note 1 to entry: The term voltage limiting SPD is used in the power area.

Note 2 to entry: The term voltage clamping SPD is used in the Telecom and signalling area.

3.1.74
voltage limiting mode of protection
voltage clamping mode of protection
mode of protection that has a high shunt impedance when no surge is present, but will reduce it continuously with increased surge current and voltage

Note 1 to entry: Common examples of components used in voltage limiting mode of protection are varistors (e.g. MOVs) and avalanche breakdown diodes (ABDs). These are sometimes called "clamping" components.

Note 2 to entry: The term voltage clamping mode of protection is used in IEC 61643-21.

3.1.75
voltage protection level
U_P
maximum voltage to be expected at the SPD connections due to an impulse stress with defined voltage steepness and an impulse stress with a discharge current with given amplitude and waveshape

3.1.76
voltage rate of rise (of a two-port SPD)
rate of change of voltage with time measured at the output connections of a two port SPD under specified test conditions

3.1.77
voltage switching SPD
SPD that contains only voltage switching mode(s) of protection

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3.1.78
voltage switching mode of protection
mode of protection that has a high impedance when no surge is present, but can have a sudden reduction in impedance in response to a voltage surge

Note 1 to entry: Common examples of components used in voltage switching modes of protection are spark gaps, gas discharge tubes (GDTs) and thyristor surge suppressors (TSS).

3.2 Abbreviated terms and symbols

Table 1 provides the list of abbreviated terms and symbols used in this document.

Table 1 – List of abbreviated terms and symbols

Abbreviated term/symbol	Description	Definition/ subclause
General acronyms and symbols		
ABD	avalanche breakdown diode	8.3.6.2
CWG	combination wave generator	3.1.6
DUT	device under test	General
IP	degree of protection of enclosure	3.1.12
k	trip current factor for overload behaviour	Table 26
PE	terminal/connection for a protective conductor	3.1.43
PEM	terminal/connection for a PEM conductor	3.1.40
PEN	terminal/connection for a PEN conductor	3.1.41
RCD	residual current device	3.1.47
SELV	safety extra-low voltage	3.1.50
PELV	protective extra-low voltage	3.1.39
SPC	surge protective component	4.14.1.4
SPD	surge protective device	3.1.61
SPDA	SPD assembly	3.1.57
T1, T2 and/or T3	product marking for T1 SPD, T2 SPD and/or T3 SPD	6.2 2)
TOV	temporary overvoltage	General
W/R	specific energy for T1 SPD test	3.1.59
Z_f	fictive impedance (of combination wave generator)	9.1.5.1 c)
Acronyms and symbols related to voltage		
U_{1mA}	nominal varistor voltage	3.1.31
U_C	maximum continuous operating voltage	3.1.23
U_{max}	highest crest value of measured voltages (used for clearance determination)	3.1.18
U_{OC}	open circuit voltage of the combination wave generator	3.1.35
U_P	voltage protection level	3.1.75
U_{res}	residual voltage	3.1.48
U_T	temporary overvoltage test value	3.1.62
U_{test}	test voltage	3.1.64

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Abbreviated term/symbol	Description	Definition/ subclause
Acronyms and symbols related to current		
I_{CW}	short-circuit current of the combination wave generator	3.1.7
I_C	continuous current	3.1.8
I_f	follow current	3.1.17
I_{imp}	impulse discharge current for T1 SPD test	3.1.19
I_L	rated load current	3.1.46
I_{max}	maximum discharge current	3.1.24
I_n	nominal discharge current for T2 SPD test	3.1.30
I_P	prospective short-circuit current of the power supply	3.1.42
I_{PE}	protective conductor current	3.1.44
I_{SCCR}	short-circuit current rating	3.1.51
$I_{SCCRMIN}$	minimum short-circuit current rating	3.1.27
I_{test}	test current	3.1.63
I_{Total}	total discharge current for multimode SPDs	3.1.67
I_{trans}	transition surge current rating	3.1.68
Acronyms and symbols related to time		
t_T	TOV application time for testing	3.1.62 and 9.3.9 of subsequent parts

4 Classification

4.1 General

The manufacturer shall classify the SPDs in accordance with the following parameters.

4.2 Number of ports

4.2.1 One

4.2.2 Two

4.3 SPD design

4.3.1 Voltage switching

4.3.2 Voltage limiting

4.3.3 Combination

4.4 Mode of protection design

4.4.1 Voltage switching

4.4.2 Voltage limiting

4.4.3 Combination

4.4.3.1 Voltage limiting and voltage switching component(s) in series

4.4.3.2 Voltage limiting and voltage switching component(s) in parallel

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4.5 Type of SPD

Information required for T1 SPD, T2 SPD and T3 SPD is given in Table 2.

Table 2 – Type of SPD

Type of SPD	Required information	Test impulse specifications (see subclauses)
T1 SPD	I_{imp}	9.1.2; 9.1.3; 9.1.4
T2 SPD	I_n	9.1.3; 9.1.4
T3 SPD	U_{OC}	9.1.5
NOTE T1 SPD, T2 SPD and T3 SPD relate to former Class I, Class II and Class III tests.		

4.6 Environment

4.6.1 Indoor

SPDs intended for use in enclosures and/or inside buildings or shelters.

NOTE 1 SPDs installed in outdoor enclosures or shelters are considered for indoor use.

NOTE 2 This classification addresses SPDs for use in weather protected locations having neither temperature nor humidity control and corresponds to the characteristics of external influences code AB4 in IEC 60364-5-51.

4.6.2 Outdoor

SPDs intended for use outside of buildings or shelters.

NOTE This classification addresses SPDs for use in non-weather protected locations.

4.6.3 Non submersible SPDs

4.6.4 Submersible SPDs

SPDs which can face temporary or permanent submersion.

4.7 Accessibility

4.7.1 Accessible

An SPD which can be fully or partly touched by an ordinary person, without the use of a tool to open any covers or enclosures, once installed.

4.7.2 Inaccessible

An SPD which cannot be touched by an ordinary person either due to being mounted out of reach or due to being located within enclosures which can only be opened by using a tool, once installed.

4.8 Mounting method

4.8.1 Fixed

SPD or SPDA complying at least with overvoltage category III according to IEC 60664-1:2020.

4.8.2 Portable

SPD or SPDA complying at least with overvoltage category II according to IEC 60664-1:2020.

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4.9 Location of disconnector (including overcurrent protection)

4.9.1 Internal

4.9.2 External

4.9.3 Both (internal and external)

4.9.4 None

4.10 Degree of protection provided by enclosures according to IEC 60529 (IP code)

4.11 Temperature and humidity range

4.11.1 Normal

4.11.2 Extended

4.12 SPD modes of protection

4.12.1 SPD providing a single mode of protection

4.12.2 Multimode SPD

4.13 End-of-life mode of the SPDA

4.13.1 Open-circuit mode (OCM)

4.13.2 Short-circuit mode (SCM)

4.14 Short-Circuit protection function for OCM end-of-life mode

4.14.1 Internal

4.14.1.1 SPD with an integrated Fuse according IEC 60269 series or 60127 series

4.14.1.2 SPD with an integrated MCB or CB according IEC 60947-2, IEC 60898 series or IEC 61009 series

4.14.1.3 SPD with an integrated specific short circuit protection function

4.14.1.4 SPD with a combined surge protection function and specific short circuit protection function (not separable)

In this case part of the surge protection functionality and the short circuit protection functionality are by design combined in a way that they physically cannot be treated separately for testing or for sample preparation.

Such SPDs require:

- another surge protective component (SPC), voltage limiting or voltage switching, having surge protection functionality only and being connected in series with the above mentioned combined functionality, and
- a significantly higher dielectric voltage withstand after short circuit interruption compared to the protection level in new condition.

NOTE Surge protection functionality is typically provided by surge protective components (SPCs), e.g. metal oxide varistors according IEC 61643-331, gas discharge tubes according IEC 61643-311, spark gaps.

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4.14.2 External

4.14.2.1 Fuse

According to the IEC 60269 series or IEC 60127 or equivalent national standards.

NOTE Fuses according IEC 60127 are only for equipment internal use, but not as installation fuses.

4.14.2.2 MCB or CB

According to the IEC 60898 series, IEC 61009 series or IEC 60947-2 or equivalent national standards.

4.14.2.3 SSD

According to IEC TS 61643-06 (currently 37A/406/CD).

NOTE SPD Specific Disconnector (SSD) is a device intended to disconnect the SPD from the power system at its end-of-life and capable of withstanding the SPD's impulse rating.

5 Void

6 Marking and other product information

6.1 General

In 6.2 a list of marking and other product information items is provided. To determine which of these items are applicable to a specific SPD, refer to the corresponding clauses of the relevant subsequent part(s) of IEC 61643.

Where space does not allow all the required markings to be placed using a font size of at least 1 mm, then at least the markings according to 6.2, 1) and 7) (if connections are not interchangeable) are sufficient on the SPD. The other required markings for which there is not enough space shall appear in the installation instructions.

An SPD may be classified to more than one Type according to 6.2, 2) (e.g. T1 SPD and T2 SPD). If in such a case the manufacturer declares only one protection level, the highest protection level shall be declared.

Compliance is checked by visual inspection.

6.2 List of items

1) Manufacturer's name or trademark, and model number
2) SPD Type classification:
   - For T1 SPD: "T1" (T1 in a square)
   - For T2 SPD: "T2" (T2 in a square)
   - For T3 SPD: "T3" (T3 in a square)

   NOTE 1 In Japan SPDs can be marked "class I" instead of T1, "class II" instead of T2 and "class III" instead of T3.

   NOTE 2 For SPDs connected to telecommunication and signalling networks according to IEC 61643-21 a different type classification applies.
3) Indication of disconnector operation (if any) or SC-means operation (if any)
4) Maximum continuous operating voltage U_C for each mode of protection (if U_C is different for each mode of protection declared by the manufacturer)

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